International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 5 Issue 2, January-February 2021 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

An Efficacy Study on Improving Balance in Subacute Stroke Patients by Proprioceptive Training with Additional Motor Imagery

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ABSTRACT

INTRODUCTION: CVA is a complex dysfunction caused by a lesion in the brain. The WHO defines stroke as an "acute neurologic dysfunction of vascular origin with symptoms and sign corresponding to the involvement of focal areas of the brain." In India the cumulative incidence of stroke ranged from 105-152/100000 persons per year, and the crude prevalence of stroke ranged from 44.29-559/100000 persons in different parts of the country during the past decade.

DESIGN: Pre-test-Post-test experimental group design

SETTING: Inpatient and outpatient of Department of Occupational Therapy, SV.NIRTAR, Olatpur.

PARTICIPANTS: A total 45 Subjects were recruited from the Swami Vivekananda National Institute of Rehabilitation Training and Research according to the inclusion and exclusion criteria.

INTERVENTIONS: After meeting the inclusion and exclusion criteria survivors were assessed using assessment performance, and informed consent was taken from the participants, allocated to the three groups.
Group 1; Proprioceptive training alone
Group 2; Proprioceptive training along with motor imagery
Group 3; Conventional therapy

OUTCOME MEASURES: Berg Balance Scale

RESULT: The study aimed to provide reference data for planning the rehabilitation of stroke patients, by comparing the effects of proprioceptive training with motor imagery and conventional proprioceptive training performed for 8 weeks.

Result of the study indicated that there was significant effect of mental imagery and proprioceptive training on balance ability of stroke patients. The changes of the motor imagery training group were better than those of the other 2 groups.

CONCLUSION: In this clinical trial, our findings suggests significant improvement in balance in sub acute stroke patients when given motor imagery training along with proprioceptive training, conventional therapy and proprioceptive training alone.

On the basis of current results, it was also concluded that, the motor imagery training along with proprioceptive training group showed a noticeable better effect on balance than those of other two groups.

KEYWORDS: *Stroke survivors, CNS, Balance, Mental imagery, Proprioceptive, exercise imagery*

How to cite this paper: Kshanaprava Dash | Mr. Rama Kumar Sahu "An Efficacy Study on Improving Balance in Subacute Stroke Patients by Proprioceptive Training with Additional Motor Imagery" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-5 | Issue-2, February 2021, pp.160-166, URL: www.ijtsrd.com/papers/ijtsrd38382.pdf

IJTSRD38382

INTRODUCTION

Cerebral vascular accident or stroke is the most common disabling neurologic disease of adulthood. It is a complex dysfunction caused by a lesion in the brain. According to WHO, Stroke is defined as "acute onset of neurologic dysfunction due to abnormality in cerebral circulation with resultant signs and symptoms that corresponds to involvement of focal area of brain lasting more than 24 hours.

It results in an upper motor neuron dysfunction that produces hemiplegia or paralysis of one side of the body, limbs & sometimes the face & oral structures that are contra lateral to the hemisphere of the brain that has the lesion..

In a hierarchical model of motor control, the CNS has a specific organizational structure and motor development and function are dependent upon the structure. This organization is in a top down orientation; that is, the higher centres of the brain regulate and exert control over lower centres of the CNS. The higher centres, specifically the cortical and sub cortical areas, are responsible for regulating and controlling volitional, conscious movement. The lower levels regulate and control reflexive, automatic and responsive movement. When damage occurs to the CNS, the damaged area can no longer regulate and exert control over the underlying areas. So more reflexive and primitive movement patterns occur.

Common mobility impairments include: lateral muscle weakness, abnormal lateral muscle tension, abnormal postural control, abnormal coordination, abnormal movement sequencing and loss of coordination. These are all factors which contribute to problems with postural control, thereby affecting standing balance ability. Standing balance ability in turn is strongly associated with walking speed. Postural control training is important contributors to the rehabilitation to reduce fall & maintain posture for walking and other daily living activities. Proprioceptive losses can result in sensory ataxia.

Balance impairments may exist when reacting to a destabilizing external force (reactive postural control) and/or during self-initiated movements (proactive or anticipatory postural control). Thus, the patient may be unable to maintain stable balance in sitting or standing or to move in the posture without loss of balance. Disruptions of central sensori motor processing contribute to an inability to recruit effective postural strategies and adapt postural movements to changing task and environmental demands.

Recently, several studies about a mental practice for rehabilitation of stroke patients have been reported. Mental imagery is a rehabilitation method, which involves the use of motor imagery content with repetition of movement processes. Mental imagery is a clinically practicable and cost-effective supplement that may enhance outcome in acute stroke patients. However, most of the previous studies of mental imagery training were conducted for chronic stroke patients.

In exercise imagery training, movement is imagined in the mind without any physical actions. The imagery induces information processing activity similar to performance of the real task, promoting the learning of motor function. The result of Functional Magnetic Resonance Imaging (FMRI), which was used to examine the validity of exercise imagery training, suggest that both the primary motor cortex and the sensory fields of brains well as the dorsal premotor cortex, superior parietal lobe and intraparietal sulcus are activated by exercise imagery training. Weight shifting interventions for hemiplegic patients suggest the possibility of exercise imagery training.

Although research regarding exercise imagery for stroke patients has been variously implemented, the enhancement of exercise performance with respect to the improvement of upper limbs function and change of brain activation has been frequently studied.

Thus, this study will examine the effects of exercise imagery on the balance ability of sub-acute stroke patients with proprioceptive training.

AIM AND HYPOTHESIS

AIM OF THE STUDY

To find out the effect of proprioceptive training with additional motor imagery on improving balance in sub acute stroke patients.

HYPOTHESIS

Proprioceptive training with motor imagery have better effect on balance of sub acute stroke patients than proprioceptive training alone.

NULL HYPOTHESIS

Proprioceptive training with motor imagery does not have any significant effect on balance of sub acute stroke patients than proprioceptive training alone.

METHODOLOGY

STUDY DESIGN-A Pre-test-Post-test experimental group design was used for the purpose of the study.

SAMPLE SIZE-A total 45 Subjects were recruited from the Swami Vivekananda National Institute of Rehabilitation Training and Research according to the inclusion and exclusion criteria.

SAMPLING-were recruited with convenient sampling in three different groups after getting the consent form.

GROUP 1 -15 Subjects- Proprioceptive training alone (Control group)

GROUP 2 -15 Subjects- Mental imagery training along with proprioceptive training (Experimental Group)

GROUP 3 -15 Subjects- Conventional therapy

INCLUSION CRITERIA

- Post stroke hemiplegic subjects of both the genders with either Right/Left side involvement
- Subjects with lower extremity Brunnstorm stage 3to 4
- MMSE should be more than 24
- Subjects within age group between 20-70 years
- Subjects should not have any speech impairment
- 1STepisode of stroke

EXCLUSION CRITERIA

- Any orthopaedic disease/trauma
- Any cognitive/perceptual deficit
- Patient with speech impairment
- Sensory deficit in lower extremities
- Subjects having epilepsy

[Conventional therapy which is provided to group 3 is adequate as decided clinically.]

[All the groups received conventional therapy without any interference to their session of therapy]

EQUIPMENT

- BALANCE BOARD
- BALANCE PAD

Screening tools

- MINI MENTAL Status EXAMINATION(Lenore kurlowiczet al.,1975)
- MODIFIED ASHWORTH SCALE (Bohannon and Smith, 1987)

Outcome measure
BERG BALANCE SCALE :- (Berg et al., 1992)

PROCEDURE
After meeting the inclusion and exclusion criteria survivors were assessed using assessment performance, and informed consent was taken from the participants, allocated to the three groups.
Group 1; Proprioceptive training alone
Group 2; Proprioceptive training along with motor imagery
Group 3; Conventional therapy

Treatment for group 1: The proprioceptive training program of 15 patients was conducted in 2 phases for 30 minutes a session, 5 days a week, for 8 weeks. For the initial 4 weeks training was conducted on a balance pad and consisted of 5 tasks. Patients were allowed to take a break of 10 seconds after performing each task and 5 trials were regarded as set 1, and a total of 5 sets were performed in 30 minutes. From 5 weeks to 8 weeks, the training was conducted on a balance board and consisted of 5 tasks. It was conducted in the same way as the initial 4 weeks. The training was conducted under the instruction and support of therapist, given the difficulty of the training, to ensure the safety of subjects.

Treatment for group 2: The motor imagery training along with proprioceptive training was conducted upon 15 patients where the proprioceptive program was consisted of 4 sets performed in 25minutes before the motor imagery training. In the motor imagery training, therapist asked the patients to imagine the contents of the proprioception program for 5 minutes, by directly reading aloud the instructions to them, in between the subjects were asked some questions in order to ensure they were adequately performing the imagery training. The motor imagery training was conducted in the rehabilitation unit with proper room temperature, with no noise, in order to enhance concentration on the motor imagery training. To lower the stress and anxiety of subjects and relax the body and mind, armchairs with a backrest were used so that so that subjects could comfortably lean on them and close their eyes.

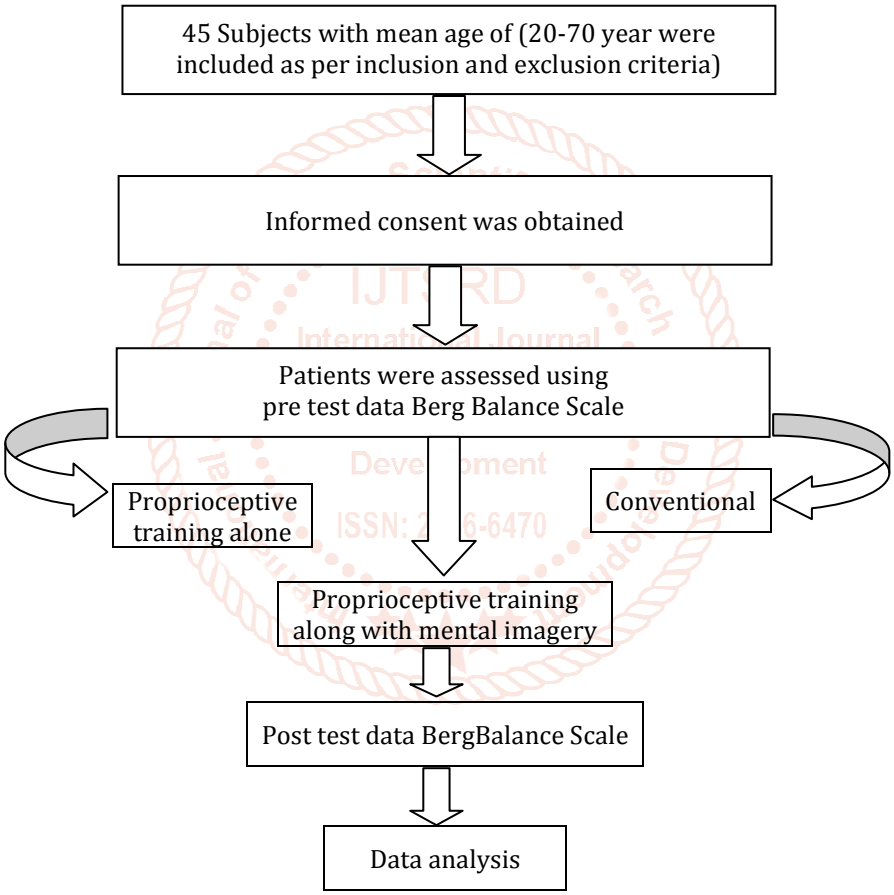
Treatment for group 3: Therapy in all the departments at SVNIRTAR as decided clinically.
[All the groups received conventional therapy without any interference to their session of therapy]

Training with balance pad (1–4 week)	Training with balance board (5–8 week)
a. Standing with two feet support posture.	f. In standing position, moving the weight left and right maximally
b. In standing position, moving both heels of feet up and down.	g. In standing position, moving the weight forward and backward maximally.
c. In standing position, bending and stretching both knees.	h. In standing position, bending and stretching both knees.
d. While standing with widening each feet forward and backward, placing the unaffected side foot on a floor and the affected side foot on balance pad, putting the body forward with bending and stretching knees.	i. In standing position, moving both heels of feet up and down.
e. In standing position, to keep your eyes closed.	j. In sitting a mat on position, sit-to-stand on a balance board.

PROTOCOL

The subjects were first screened according to inclusion and exclusion criteria and the one fulfilling the criteria of the study were selected. The attendances of the patient were approached with the proposal of the study and the aims and the methods of the study were explained. Those who were willing to participate were invited to join the study and were asked to sign the consent form.

[All the groups received conventional therapy without any interference to their session of therapy]



DATA ANALYSIS AND RESULT

45 subjects were randomly selected for the study with the mean age of 20 to 70.The SPSS 23 was used for analysis; the data of all subjects were being assessed by Berg Balance Scale. Each assessment was followed by reassessment at the end of 8 weeks post-intervention.The data were analysed by using Kruskal-Wallis test and Jonckheere trend test. Kruskal-Wallis test has been used to analyse whether there are differences between these three groups and not which results are better or worse than the other. However, it calculates the value of H, which represented significance difference between the groups. Jonckheereterpestra test has been used for predicting a definite direction to the results i.e. which group performs the best.

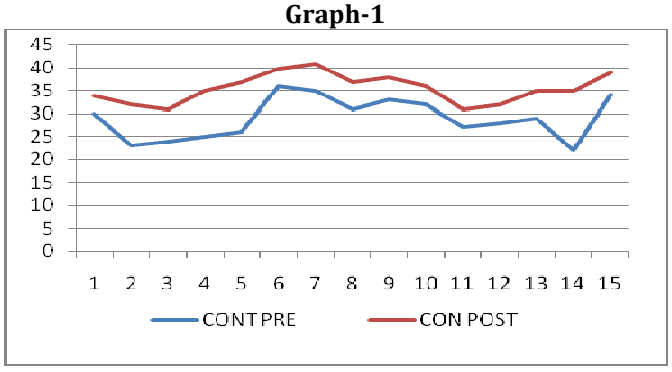
[Table 1 shows the difference between the mean score and standard deviation of all the three groups on Berg balance scale.]

Outcome measure	Group 1 (N=15)				Group 2 (N=15)				Group 3 (N=15)			
	Mean test score		Std. Dev		Mean test score		Std. Dev		Mean test score		Std. Dev	
	Pre test	Post test	Pre test	Post test	Pre test	Post test	Pre test	Post test	Pre test	Post test	Pre test	Post test
Berg Balance score	29.0	35.53	4.47	3.18	29.00	39.86	4.47	7.07	29.0	30.33	4.47	4.57

Table 2; Descriptive statistics BBS Group 1(control group)

Scale	No. Of patients	Mean	Std. Deviation
BBSPRE 1	15	29.00	4.472
BBS POST 1	15	35.53	3.181

Graph-1



Column-1

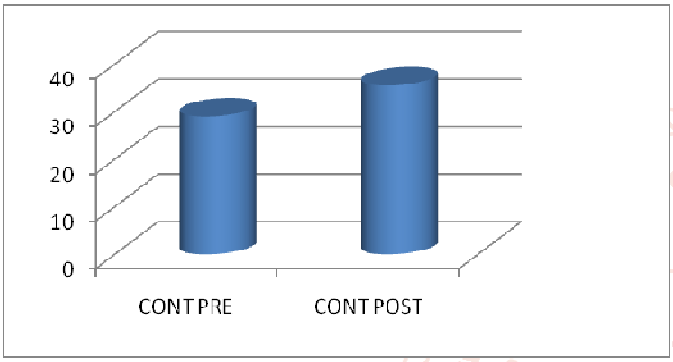


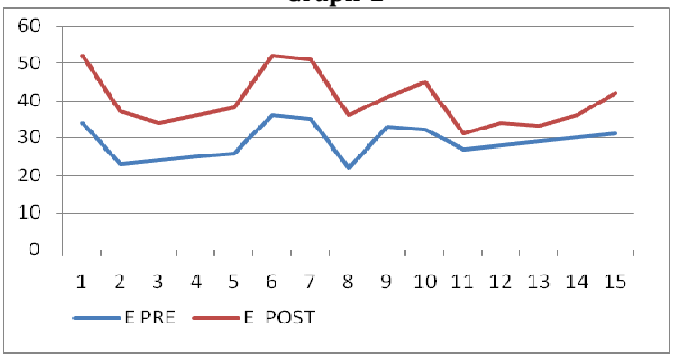
Table 2 shows the difference between the mean and standard deviation of pre test and post test of the control group on Berg balance scale. Pre test mean score is 29 and post test score is 35.53 and the standard deviation for the pre test and post test is 4.47 and 3.18 respectively.

Graph 1 and Column 1shows the difference between pre test and post test on Berg Balance Scale of the control group. The post test shows higher test score than pre test score.

Table 3; Descriptive statistics BBS Group 2(Experimental Group)

SCALE	No. Of patients	Mean	Std. Deviation
BBS PRE2	15	29.00	4.47
BBS POST 2	15	39.86	7.07

Graph-2



Column-2

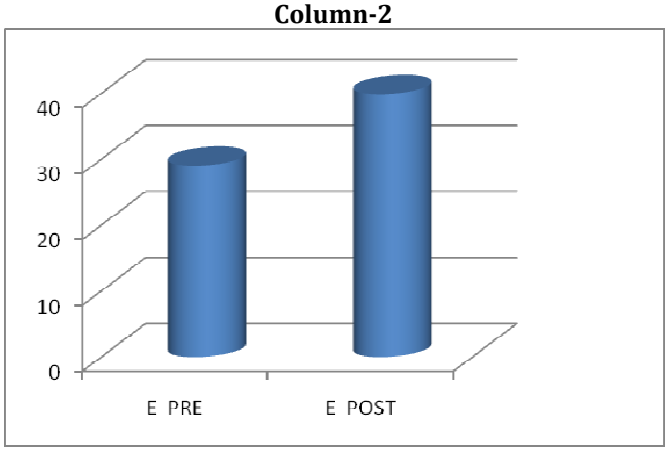
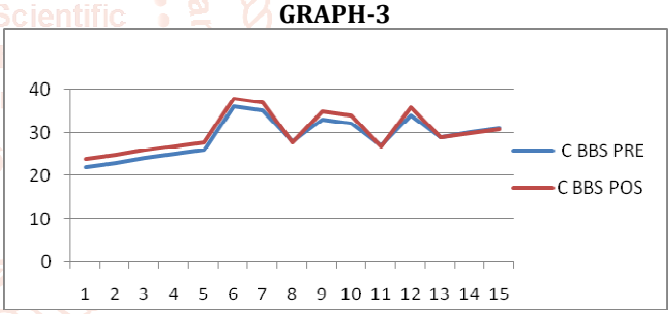


Table 3 shows the difference between the mean and standard deviation of pre test and post test of the experimental group on Berg balance scale. Pre test mean score is 29 and post test score is 39.86 and the standard deviation for the pre test and post test is 4.47 and 7.07 respectively. Graph 2 and Column 2 shows the difference between pre test and post test on Berg Balance Scale of the control group. The post test shows higher test score than pre test score.

Table 4; Descriptive statistics BBS Group 3 (Conventional group)

Scale	No. Of patients	Mean	Std. deviation
BBS Pre 3	15	29.00	4.47
BBS Post 3	15	30.33	4.57

GRAPH-3



COLUMN-3

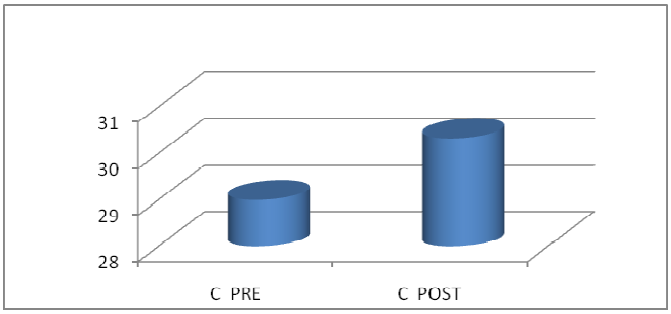


Table 4 shows the difference between the mean and standard deviation of pre test and post test of the experimental group on Berg balance scale. Pre test mean score is 29 and post test score is 39.86 and the standard deviation for the pre test and post test is 4.47 and 4.57 respectively.

Graph 3 and Column 3 shows the difference between pre test and post test on Berg Balance Scale of the control group. The post test shows higher test score than pre test score.

Table 5 and 6; showing result of Kruskal-Wallis and Jonckheere-Terpstra test for BBS Gr1, Gr2 and Gr3

Test Statistics

	BBS
Chi-Square	15.349
df	2
Asymp. Sig.	0.000

Jonckheere-Terpstra

Observed J-T Statistics	221.500
Mean J-T Statistics	337.500
Standard deviation of J-T Statistics	47.906
Standard J-T Statistics	-2.421
Asymp. Sig.(2-tailed)	0.015

Jonckheere- Terpstra test has been used for testing the trend in group performance between the 3 groups.

Significant level- J-T Statistics of **-2.421** corresponds to a level of significance at 0.015

Inference- The level of significance of 0.015 is lesser than set level of confidence of 0.05; hence it supports the proposed or experimental hypothesis. Thus, the experimental hypothesis is accepted and the null hypothesis is rejected.

DISCUSSION

The study aimed to provide reference data for planning the rehabilitation of stroke patients, by comparing the effects of proprioceptive training with motor imagery and conventional proprioceptive training performed for 8 weeks.

Result of the study indicated that there was significant effect of mental imagery and proprioceptive training on balance ability of stroke patients. The changes of the motor imagery training group were better than those of the other 2 groups.

These results are in agreement with previous 2 studies i.e. the static and dynamic balance index increased after motor imagery training, and another study says when motor imagery training was added to conventional movement training the symmetry of muscle activity and its timing improved in stroke patients.

Previous study suggested that in motor imagery training with proprioception program, activation of the cerebrum and cerebellum affected proprioception and the visual and vestibular organs responsible for balance ability, in particular, the activation of the proprioception sensing the position and movements of joints affects the balance ability.

It is also believed that other factors such as level of familiarity and task complexity interact to determine effects.

However, it is still not clear whether the benefits of combination treatment are due to improvement in cognitive models of the movements being performed, motivation mechanisms, or to the indirect effect of mental practice on neuroplasticity.

In the present study proprioception with motor imagery training showed greater improvement than proprioceptive training, indicating that the balance ability, postural symmetry and proprioception of the subjects were enhanced.

These results suggests that proprioception with motor imagery can be used as a treatment option to improve the balance ability of sub acute stroke patients.

Motor imagery can be conducted anywhere (but the place must be quiet and free of noise), and at any time without treatment tools, and can be used together with variety long-term rehabilitation approaches for the treatment of patients with severe disabilities.

In addition, motor imagery requires little energy consumption and motor skills can be learned effectively in motor imagery training without fear of injury.

CONCLUSION

In this clinical trial, our findings suggests significant improvement in balance in sub acute stroke patients when given motor imagery training along with proprioceptive training, conventional therapy and proprioceptive training alone.

On the basis of current results, it was also concluded that, the motor imagery training along with proprioceptive training group showed a noticeable better effect on balance than those of other two groups.

Though the present study has a few limitations which could be further suggested for future study programmes. However, it makes noteworthy contributions to the clinical aspect of the stroke survivors.

REFERENCES

[1] Al-Abood SA, Davids KF, Bennett SJ: Specificity of task constraints and effects of visual demonstrations and verbal instructions in directing learners' search during skill acquisition. J Mot Behav, 2001, 33: 295–305. [Medline] [CrossRef]

[2] Bakker M, de lange F, helmich R, Scheeringa R, Bloem B and toni I. cerebral correlates of motor imagery of normal and precision gait. NeuroImage 2008; 41: 998–1010.

[3] deHaart M, Geurts AC, Huidekoper SC, et al.: Recovery of standing balance in postacute stroke patients: a rehabilitation cohort study. Arch Phys Med Rehabil, 2004, 85: 886–895.

[4] diRienzo F, collet c, hoyek N, Guillot A. Impact of neurologic ations. Neuropsychol Rev 2014; 24: 116–147.

[5] Dunsky A, Dickstein R, Marcovitz E, et al.: Home-based motor imagery training for gait rehabilitation of people with chronic poststroke hemiparesis. Arch Phys Med Rehabil,

[6] Fansler CL, Poff CL, Shepard KF: Effects of mental practice on balance in elderly women. PhysTher, 1985, 65: 1332–1338. [Medline]

[7] Féry YA: Differentiating visual and kinesthetic imagery in mental practice. Can J ExpPsychol, 2003, 57: 1–10. [Medline] [CrossRef]

[8] Filimon F, Nelson JD, Hagler DJ, et al.: Human cortical representations for reaching: mirror neurons for execution, observation, and imagery. Neuroimage, 2007, 37: 1315–1328. [Medline] [CrossRef]

[9] Gerardin E, Sirigu A, Lehéricy S, et al.: Partially overlapping neural networks for real and imagined hand movements. Cereb Cortex, 2000, 10: 1093–1104. [Medline] [CrossRef]

[10] Hwang S, Jeon HS, Yi CH, et al.: Locomotor imagery training improves gait performance in people with chronic hemiparetic stroke: a controlled clinical trial. ClinRehabil, 2010, 24: 514–522. [Medline] [CrossRef]

[11] Ikai T, Kamikubo T, Takehara I, et al.: Dynamic postural control in patients with hemiparesis. Am J Phys Med Rehabil, 2003, 82: 463–469, quiz 470–472, 484. [Medline] [CrossRef]

[12] Imagery training improve hand function in chronic stroke patients? A pilot study. clinRehabil 2004; 18: 538–549.

[13] Jackson PL, Doyon J, Richards CL, et al.: The efficacy of combined physical and mental practice in the learning of a foot-sequence task after stroke: a case report. Neurorehabil Neural Repair, 2004, 18: 106–111. [Medline] [CrossRef] [Medline] [CrossRef]

[14] Johannsen L, Broetz D, Kamath HO: Leg orientation as a clinical sign for pusher syndrome. BMC Neurolo, 2006, 6: 30.

[15] Kerrigan DC, Karvosky ME, Riley PO: Spastic paretic stiff-legged gait: joint kinetics. Am J Phys Med Rehabil, 2001, 80: 244–249. [Medline] [CrossRef]

[16] langhorne P, coupar F, Pollack A. Motor recovery after stroke: a systematic review. lancetNeurol 2009; 8: 741–754.

[17] Malouin F, Richards CL: Mental practice for relearning locomotor skills. PhysTher, 2010, 90: 240–251. [Medline] [CrossRef]

[18] Munzert J, lorey B, zentgraf K. cognitive motor processes: the role of motor imagery in the study of motor presentations. Brain Res Rev 2009; 60: 306–326